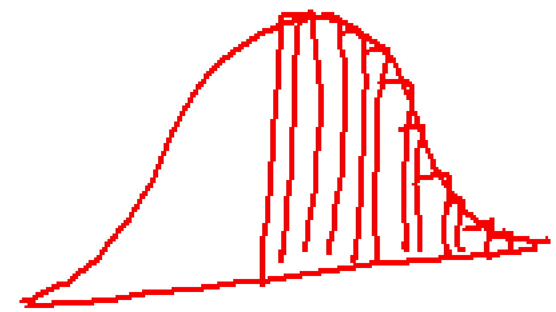
5.1 (part 2) notes: Binomial Variables, large sample size

- distribution of $X \approx$ normal



- check: $n \cdot p \geq 10$, $n(1-p) \geq 10$

$P(30 \leq X \leq 45)$

- say that $X \approx$ normal
- use normalcdf(LB, UB, μ_x, σ_x)
- same from formula sheet

Ex $B(125, 0.75)$

Check

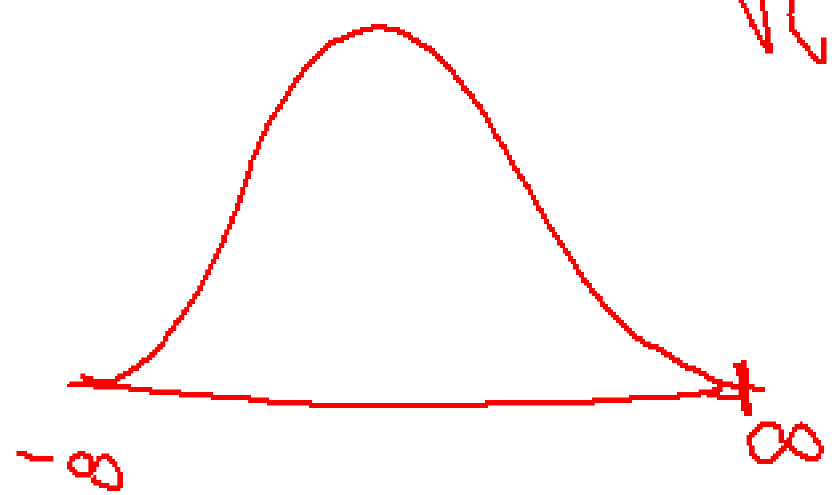
$(125)(0.75)$
$(125)(0.25)$ ≥ 10 ✓

$P(X>80)$

$\cancel{e^{99}}$

$= \text{normalcdf}\left(80, e99, (125 \cdot 0.75), \sqrt{(125 \cdot 0.75 \cdot 0.25)}\right)$

$= 0.9977$



binomials = <u>discrete</u>

approx w/ <u>continuous</u> (normal curve)

why? normalcdf

- easier
- prob. is <u>very</u> close to binomcdf

$P(X>80) = 1 - P(X \leq 80) = 0.9959$

Proportions

$P(X > 80)$

$P(\hat{p} > 0.40)$

$B(125, 0.75)$

p

p = pop. prop. (%)

$\hat{p}$ = sample prop (%)

$= \dfrac{X}{n}$ ← successes, ← sample size

$\hat{p}$ is continuous

range: $0 \le \hat{p} \le 1$

$$\hat{p} \sim N\left(p, \sqrt{\frac{p(1-p)}{n}}\right)$$

$$\mu_{\hat{p}} \qquad \sigma_{\hat{p}}$$

<u>check:</u>

np

$n(1-p) \geq 10$

$p \sim$ normal

Ex: $B(1{,}000, 0.15)$

$\uparrow$ p

Check

$(1000)(0.15) \geq 10$
$(1000)(0.85)$

$P(\hat{p} > 0.14)$

$= \text{normalcdf}\left(0.14, E99, 0.15, \sqrt{(0.15 \cdot 0.85)/1000}\right)$

$\mu_{\hat{p}}$ $\quad \sigma_{\hat{p}}$

$= 0.812$

5.1 wksht

4. $B(700, 0.05)$

Check

$700 \cdot 0.05$

$700 \cdot 0.95$

10

$P(X \geq 50) =$

$\text{normalcdf}\left(50, E99, \underbrace{(700 \cdot 0.05)}_{\mu_x}, \underbrace{\sqrt{(700 \cdot 0.05 \cdot 0.95)}}_{\sigma_x}\right)$

$= 0.0464$

5 $B(400, 0.48)$

check

$(400)(0.48) \geq 10$ ✓

$(400)(0.52)$ ✓

$P(0.45 \leq \hat{p} \leq 0.55)$

$= \text{normalcdf}(0.45, 0.55, \underbrace{0.48}_{\mu_{\hat{p}}}, \underbrace{\sqrt{(0.48 \cdot 0.52)/400}}_{\sigma_{\hat{p}}})$

$= 0.8826$